01-02-08



THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | |
|---|---|
| In Re U.S. Patent Application of: Woodruff, et al. | Group Art Unit: 1742 |
| Conf. No.: 2206 | Examiner: Lois L. Zheng |
| Application No. 10/084,962 | |
| Filed: February 27, 2002 | |
| For: Electroplating Apparatus With Segmented Anode Array | |

TRANSMITTAL OF AMENDED APPEAL BRIEF

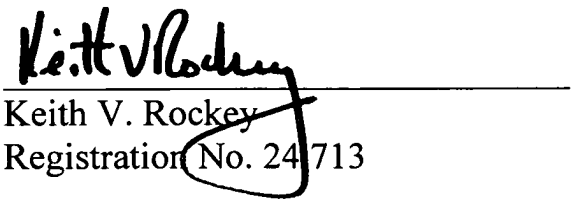
Mail Stop Appeal Brief - Patents
Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir/Madam:

Pursuant to the Notification of Non-Compliant Appeal Brief dated November 30, 2007, applicants in the above-identified application hereby submit their Amended Appeal Brief.

Applicants believe there is no fee associated with the filing of said Amended Appeal Brief. However, if applicants' belief is mistaken and a fee is required, the Commissioner is hereby authorized to charge any such fees to Deposit Account No. 50-3891. A duplicate copy of this sheet is enclosed.

Respectfully submitted,



Keith V. Rockey
Registration No. 24713

ROCKEY, DEPKE & LYONS, LLC
Sears Tower, Suite 5450
233 South Wacker Drive
Chicago, Illinois 60606
(312) 277-2006

December 31, 2007

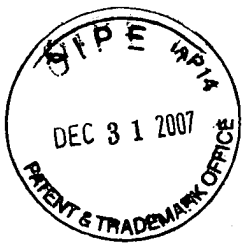
CERTIFICATE OF MAILING (37 C.F.R. § 1.10)

Express Mail Label No. EM 154875756 US

Date of Mailing: December 31, 2007

I hereby certify that this correspondence and fee are, on the date shown above, being deposited with the United States Postal Service with sufficient postage as Express Mail, Post Office to Addressee, in an envelope addressed to MAIL STOP APPEAL BRIEF - PATENTS, Commissioner For Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Eileen Madrigal




THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | |
|---|---|
| In Re U.S. Patent Application of: Woodruff, et al. | Group Art Unit: 1742 |
| Conf. No.: 2206 | Examiner: Lois L. Zheng |
| Application No. 10/084,962 | |
| Filed: February 27, 2002 | |
| For: Electroplating Apparatus With Segmented Anode Array | |

# APPLICANTS' AMENDED APPEAL BRIEF

TABLE OF CONTENTS


I. REAL PARTY IN INTEREST ..... 1

II. RELATED APPEALS AND INTERFERENCES ..... 1

III. STATUS OF CLAIMS ..... 1

IV. STATUS OF AMENDMENTS ..... 2

V. SUMMARY OF CLAIMED SUBJECT MATTER ..... 2

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL ..... 7

VII. ARGUMENT ..... 8

A. The Examiner Notwithstanding, Lowery Fails To Anticipate ..... 8

B. The Van Raalte Patent Is Directed To An Entirely Different Field And Is Even More Remote ..... 10

C. Deficient Also Is the Inagaki Published Application ..... 12

D. Unfounded Also Are the Examiner's Rejections Based on Hirohiko Alone Or In Combination With Van Raalte ..... 14

VIII. CLAIMS APPENDIX ..... I

IX. EVIDENCE APPENDIX ..... VI

X. RELATED PROCEEDINGS APPENDIX ..... VII

TABLE OF AUTHORITIES

Atofina v. Great Lakes Chemical Corporation
(Fed. Cir., 2006), 441 F.3d 991 ..... 8

On Demand Machine Corp. v. Ingram Industries, Inc.
(Fed. Cir., 2006), 442 F.3d 1331 ..... 10

Applicants submit this Appeal Brief in furtherance of the Notice of Appeal mailed in accordance with 37 C.F.R. §1.8(a) on June 4, 2007. Applicants request a three-month extension of time; hence this Brief is timely filed. This application was filed to provoke an interference with U.S. Patent No. 6,193,860, issued on February 27, 2001 to Weling. Applicants copied or substantially copied claims 1, 3, 5-16 and 20-24 of the '860 patent.

## I. REAL PARTY IN INTEREST

All right, title and interest in and to this patent application has previously been assigned to Semitool, Inc.

## II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences to this patent application.

## III. STATUS OF CLAIMS

The application was filed with claims 1 through 16, all of which were cancelled by way of a preliminary amendment and replaced with claims 17-34. The status of the claims is as follows:

(a) claims 17-34 are pending;

(b) no claims have been withdrawn from consideration;

(c) no claims have been cancelled;

(d) claims 17-34 have been rejected;

(e) no claims have been objected to;

(f) claims 17-34 are on appeal.

Each of claims 17-34 on appeal is included in the attached Appendix A.

## IV. STATUS OF AMENDMENTS

No Amendments have been filed subsequent to the final rejection of the claims in the Final Office Action of June 4, 2007.

## V. SUMMARY OF CLAIMED SUBJECT MATTER

The present invention relates to an electroplating device (see, for example, Figs. 1-5 as described in the present specification on pages 6 et seq.). The electroplating device claimed is used in the metallization of semiconductor wafers (Fig. 14, Item W), and particularly semiconductor wafers formed of silicon. The electroplating reactor 10 is illustrated in Fig. 1 of the drawings and represents

that portion of the apparatus which generally contains the electroplating solution. As illustrated in Fig. 14, mounted above the reactor 10 is the associated workpiece W to be plated which is positioned generally downwardly. The plating solution flows from the reactor vessel 12, over a weir-like periphery and into an overflow chamber 14 of the reactor 10.

The reactor 10 includes a riser tube having an inlet conduit 18 by which electroplating solution is introduced to the reactor vessel. Important to the concept of the invention is a segmented anode array 20 positioned near the upper extent of the conduit 18 to promote flow of the electroplating solution over and about the anode array 20. During processing, a rotor assembly 22, described in greater detail in Fig. 14, receives and holds a workpiece W in an opposing relationship to the anode array 20. The reactor vessel 10 has an axis, with the workpiece being mounted generally transverse to the axis. By the same token, the anode array 20 is likewise positioned in a generally transverse relationship to the axis as well. In the preferred embodiment, the workpiece W is rotatably driven by a drive motor 24 of the rotor assembly to facilitate uniform deposition of electroplated metal on the surface of the workpiece W.

Figs. 2-5 generally describe and provide an illustrative embodiment of the segmented anode array 20 containing a plurality of anode segments have differing dimensions, with at least one of the anode segments having a relatively greater dimension being positioned further from the axis of the reactor vessel than other anode segments having smaller dimensions. In the preferred embodiment as described in those figures, the anode segments comprise singular ring-like elements, each generally toroidal and arranged in a concentric relationship relative to one another.

As an example and as illustrated in Figs. 2, 3 and 5, the segmented anode array 20 may include four segments, designated as elements 30, 32, 34 and 36, with relatively decreasing diameters from the outer periphery of the reactor toward the center.

In operation, the electroplating solution is pumped through the inlet conduit 18, through the flow passage defined by the collar 42 and through the center of the anode array whereby the solution impinges upon the surface of the workpiece W. The plating rate at the surface of the workpiece, as a general principle, will vary radially by reason of the liquid electroplating solution

impinging on the boundary layer. That radial variation of the plating rate relative to the radial position from the axis can be compensated for by operating the anode segments at different electric potentials. In addition, to further control plating uniformity, the various anode segments can be operated not only at differing potentials but also for differing periods of time.

The claims on appeal include two independent claims, namely claims 17 and 32. Claim 17 calls for a system for electroplating a layer of material on a semiconductor wafer, and the first clause of the claim calls for an electrochemical cell comprising a primary anode, a cathode contact and a chamber, with the primary anode and the cathode contact being disposed within the chamber. That includes the structure described in the specification including the electroplating reactor 10 having a segmented anode array 20 and a rotor assembly which receives and holds the workpiece and thus functions as a cathode contact (see, for example, page 6, lines 19-30 and page 7, lines 1-5). Both the rotor and the segmented anode 20 are described in, for example, Fig. 1 as within the reactor vessel or cup 12 (see page 6, lines 19-30).

Claim 17 also calls for a secondary anode for the purpose of providing a variable current to the wafer, and that includes anode segments 32, 34 and 36 having decreasing diameters as described at page 7, lines 28 and 29. The present specification (page 8, lines 18-27) describes providing a variable current to the wafer. Claim 17 also calls for a metallic solution in the cell, and that is described at page 6, lines 28-30, referring to introduction of electroplating solution into the reactor.

Claim 17 also calls for a power source coupled to the primary anode, the secondary anode and the cathode contact, capable of producing variable current by providing varying levels of voltage to the anodes. The power source may be, as described in Fig. 1A and on page 8, lines 20-27, a power source providing variable potentials to each of the various anode segments, thus producing variable current as claim 17 requires. See page 8, lines 14-27, as one example.

Claim 32, the other independent claim on appeal, calls for an anode system for performing an electroplating operation which includes a plurality of anodes insulatively coupled together. The plurality of anodes is described at page 7, lines 28 and 29. They are insulatively coupled together, as described on page 8,

lines 28-30 and also Fig. 5 of the drawings, to provide varying voltage levels as further described on page 8, lines 20-21. Claim 32 also calls for a plurality of leads coupled to the anodes. That is described in the present specification on page 9, lines 2-30, referring to independent control of the plating process.

## VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The following issues are presented for review by this Board:

(a) Whether claims 17 and 21-22 are anticipated under 35 U.S.C. § 102(b) by Lowery U.S. Patent No. 5,670,034.

(b) Whether claims 17, 21-22 and 24-32 are anticipated under 35 U.S.C. § 102(b) by Van Raalte U.S. Patent No. 3,880,725.

(c) Whether claims 17-22 and 24-34 are anticipated under 35 U.S.C. § 102(b) by Inagaki JP 59-150094.

(d) Whether the subject matter of claims 17-29 would have been obvious under 35 U.S.C. § 103 in view of Japanese published application Hirohiko JP 04-311591.

(e) Whether the subject matter of claims 30-34 would have been obvious under 35 U.S.C. § 103 in view of Hirohiko in view of Van Raalte.

(f) Whether the subject matter of claim 23 would have been obvious under 35 U.S.C. § 103 in view of Inagaki.

## VII. ARGUMENT

### A. The Examiner Notwithstanding, Lowery Fails To Anticipate

The Lowery patent, relied upon as an anticipatory reference, teaches a plating system for depositing a variety of metals on what the patent describes as "circuit chips". The patentees describe the plating system as including a reaction vessel or tank 12 which contains an electrolytic solution. Mounted in the tank is a system for rotably mounting a workpiece in which the workpiece is immersed in the plating solution and rotated about what the patentees describe as a first axis. An anode assembly is mounted in the tank in such a way that it is "translated from side to side" in front of the substrate plate (col. 2, l. 56). It is the translation of the

anode which is used to promote uniformity in the plating on the substrate or workpiece.

Lowery teaches the concept of commonly connected anodes which are configured in such a way that the voltage from one to another is essentially the same. Herein lies the reason that the Examiner's position that Lowery anticipates the claims must necessarily fail. The claims here call for the use of a primary anode and at least one secondary anode to provide a variable current to the semiconductor wafer, very much unlike Lowery's commonly connected anodes. The claims specify a variable current to the wafer, and that limits the structure of the secondary anode to an anode which is electrically independent of the primary anode to provide varying levels of voltage to the primary and secondary anodes. Those are, the Examiner notwithstanding, structural limitations which unmistakably distinguish the present claims over the Lowery reference (Atofina v. Great Lakes Chemical Corporation (Fed. Cir., 2006), 441 F.3d 991, 1000).

The claims as written require primary and secondary anodes to be separately connected and controlled. The Examiner has suggested that the anodes disclosed by Lowery are "inherently capable of providing the claimed variable

current" to the semiconductor wafer -- an argument that is entirely unsupported by the teachings of the Lowery reference.

This Board should reverse the Examiner's rejection as unfounded based on the theory that Lowery anticipates the present claims.

B. The Van Raalte Patent Is Directed To An Entirely Different Field And Is Even More Remote

The Examiner has also rejected claims 17, 21-22 and 24-32 as anticipated by Van Raalte under 35 U.S.C. § 102(b). The Van Raalte patent is directed to an entirely different system having an entirely different application as compared to the claims in this application. While Van Raalte's teachings are somewhat vague as to the chemical make-up of the substrate to be plated, Van Raalte discusses little more than an "article 12" without saying much more about its nature. The patentees say (col. 2, ll. 14 et seq.):

> "The surface of the article 12 should be somewhat conductive and capable of maintaining an electrical potential, e.g., a metal."

In reviewing the specification, the field of the invention makes it clear that the problems addressed by Van Raalte are wholly unlike those which the present

invention involves, and, for that reason, does not describe a system which includes a semiconductor wafer as the substrate to be plated. The patentees describe in column 1, lines 20 et seq., the application of depositing a metal film in the manufacture of "light valves". The specification goes on to teach that light valves include (col. 1, ll. 22 et seq.):

> "Electrostatically deformable films wherein an electrostatic charge pattern deposited on one side in accordance with external video signals acts on the adjacent light reflective film to produce a corresponding pattern of local deformations therein."

Therefore, Van Raalte cannot be viewed as a reference capable of anticipating the present invention relating to the plating of semiconductor wafers as the present claims specify. As is well established in the art, the problems faced in the plating of semiconductor wafer are unique as compared to the plating of metals generally with which Van Raalte is concerned.

The Examiner's position seems to be that the limitations in the claims calling for plating of semiconductor wafers merely recites an intended use, and is therefore not a structural limitation of the claims. The Examiner's position here

boils down to the assertion that the preamble to the claims, in calling for plating of semiconductor wafers, merely recites the use to which the apparatus is put, and does not represent a limitation on the claim. On that argument, applicants submit that the Examiner is wrong. Far from being an intended use, the preamble to the claims in this application give life and meaning to the claims and therefore the limitations that they recite must be given weight in defining the invention (On Demand Machine Corp. v. Ingram Industries, Inc. (Fed. Cir., 2006), 442 F.3d 1331, 1343). Even the Examiner agrees that Van Raalte's structure is different when taking into account the preamble, but the Examiner is wrong in refusing to give the words in the preamble patentable weight.

This Board should therefore set aside as unfounded the rejection based on the theory that Van Raalte anticipates the present claims.

C. Deficient Also Is the Inagaki Published Application

The Examiner has also rejected claims 17-22 and 24-34 as anticipated by the Iganaki published Japanese application.

The Iganaki reference is directed to a plating device which has, as its object, uniform control of current density in the plating operation. The published application purports to describe three pieces of annular anodes 41, 42 and 43 concentrically mounted in an anode chamber 24, with the parts being electrically insulated between them. The Examiner has recognized that the Iganaki reference fails to teach various levels of voltage to different anodes as the claims in this application require, but has argued that the limitation is "inherent" in the prior art, or, in the alternative, such a limitation does not distinguish the apparatus claim from the prior art.

That is an entirely improper analysis of both the present claims and the prior art. The prior art admittedly fails to teach the concept of various levels of voltage to different anodes as the claims require. It is no answer to suggest that such characteristics are inherent. Quite the contrary, the claims expressly describe those limitations and the Examiner should not be free to ignore them altogether as has been the case here. Indeed, the apparatus is claimed in such a way that the structural requirements include various levels of voltages on different anodes as a matter of the structure of the anode. That is the very heart of the invention claimed

here. The Examiner should not be permitted to ignore those claim limitations as indeed the rejection would suggest.

This Board should reverse the rejection that Iganaki anticipates the claims here. That is particularly true when it is remembered that the claims in this application have been substantially copied from the Weling patent.

D. Unfounded Also Are the Examiner's Rejections Based on Hirohiko Alone Or In Combination With Van Raalte

The Examiner has also rejected a number of the claims based on the Hirohiko patent premised on 35 U.S.C. § 103. Hirohoko, discussed during the prosecution of the application, suffers from the same deficiencies as the Iganaki reference, namely both fail to teach providing various levels of voltages to different anodes as the claims require.

The Van Raalte reference fails to overcome the deficiencies of Hirohoko for the reasons explained above.

Indeed, the Examiner's position in this entire application seems to be premised on the notion that the limitations of the present claims distinguishing

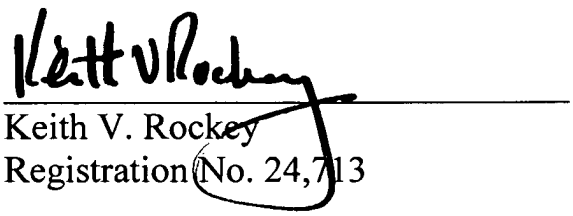
over the prior art should not be given weight because the invention claimed in the present application is apparatus. Once again, this Board should keep in mind that the claims in this application were copied, either literally or substantially, from an issued patent, namely the Weling patent. Applicants suggest that it is entirely inappropriate for the Patent and Trademark Office to allow claims to one party but then turn around and deny them to another by taking legally inconsistent positions. The claims here distinguish over the prior art in calling for various levels of voltages to different anodes, a concept lacking from the prior art. While those limitations have process ramifications, so too do they also have ramifications from a standpoint of the structure. It seems entirely inappropriate to give weight to those same limitations in one application while taking a contrary and inconsistent position in another.

This Board should therefore reverse the rejections based on Hirohiko either alone or in view of Van Raalte.

## CONCLUSION

The Examiner's rejection of these claims is in error and should be reversed.

Respectfully submitted,



Keith V. Rockey
Registration No. 24,713

ROCKEY, DEPKE & LYONS, LLC
Sears Tower, Suite 5450
233 South Wacker Drive
Chicago, Illinois 60606
(312) 277-2006

December 31, 2007

## VIII. CLAIMS APPENDIX

17. A system for electroplating a layer of material on a semiconductor wafer, said system comprising:

an electrochemical cell, said electrochemical cell comprising a primary anode, a cathode contact, and a chamber, said primary anode and said cathode contact disposed within said chamber;

at least one secondary anode, said secondary anode for providing a variable current to said semiconductor wafer;

a metallic solution, said metallic solution disposed within said electrochemical cell; and

a power source, said power source coupled to said primary anode, to said at least one said secondary anode and to said cathode contact, said power source capable of producing said variable current by providing varying levels of voltage to said primary anode and to said secondary anode.

18. The system as recited in claim 17 wherein said at least one secondary anode is a ring shaped anode.

19. The system as recited in claim 17 wherein said at least one secondary anode is comprised of a first secondary anode and a secondary anode.

20. The system as recited in claim 19 wherein said first secondary anode and said second secondary anode are comprised of a first concentric ring and a second concentric ring.

21. The system as recited in claim 17 further comprising:

a semiconductor wafer, said semiconductor wafer coupled to said cathode contact, said semiconductor wafer acting as a cathode and thereby receiving an electroplated film on its surface.

22. The system recited in claim 17 wherein said at least one secondary anode is disposed within said chamber of said electrochemical cell.

23. The system recited in claim 17 wherein said metallic solution is a copper solution.

24. The system recited in claim 17 wherein said power source provides said variable electrical current as a function of respect to elapsed time of said electroplating operation.

25. The system recited in claim 17 wherein said power source provides said variable electrical current as a function of physical location of application of said variable electrical current to said semiconductor wafer.

26. The system recited in claim 17 wherein said power source provides said variable electrical current as a function of respect to a voltage that exists at discrete locations on said semiconductor wafer being electroplated.

27. The system recited in claim 17 wherein said power source provides said variable electrical current as a function of variation in a profile of said primary anode and at least said at least one secondary anode used in said electroplating operation.

28. The system recited in claim 17 wherein said power source provides said variable electrical current as a function of an influence of said chamber of said electrochemical cell on a theoretically uniform electric field.

29. The system recited in claim 17 wherein said power source provides aid variable electrical current as a function of a thickness of said layer of material electroplated onto said semiconductor wafer.

30. The system recited in claim 17 wherein said power source provides a lower current value at an outer portion of said semiconductor wafer and wherein said power source provides a higher current value at an inner portion of said semiconductor wafer.

31. The system recited in claim 17 wherein said power source provides said variable electrical current by providing a variable voltage across said primary anode with respect to said at least one secondary anode.

32. An anode system for performing an electroplating operation, said anode system comprising:

a plurality of anodes, said plurality of anodes for performing an electroplating operation on a part, said plurality of anodes insulatively coupled together, said electroplating operation controlled by providing a variable current on said plurality of anodes via varying levels of voltage; and

a plurality of leads, each of said plurality of leads respectively coupled to one of said plurality of anodes, each of said plurality of leads insulatively coupled to any other said plurality of leads such that each of said

plurality of leads has the capability of providing an independent electrical current from a power source to its respective one said plurality of anodes.

33. The anode system recited in claim 32 wherein at least one of said plurality of anodes is a ring-shaped anode.

34. The anode system recited in claim 32 wherein at least one of said plurality of anodes is disposed annularly within at least another of said plurality of anodes.

## IX. EVIDENCE APPENDIX

None.

## X. RELATED PROCEEDINGS APPENDIX

None.

CERTIFICATE OF MAILING (37 C.F.R. § 1.10)

Express Mail Label No. EM 154875756 US

Date of Mailing: December 31, 2007

I hereby certify that this correspondence and fee are, on the date shown above, being deposited with the United States Postal Service with sufficient postage as Express Mail, Post Office to Addressee, in an envelope addressed to MAIL STOP APPEAL BRIEF - PATENTS, Commissioner For Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Eileen Madrigal